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the COST ES0701 experience

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Benchmarking and testing the "Sea Level Equation": the COST ES0701 experience

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The study of the process of Glacial Isostatic Adjustment (GIA) and of the consequent sea level variations is gaining an increasingly important role within the geophysical community. Understanding the response of the Earth to the waxing and waning ice sheets is crucial in various contexts, ranging from the interpretation of modern satellite geodetic measurements to the projections of future sea level trends in response to climate change. All the processes accompanying GIA can be described solving the so-called Sea Level Equation (SLE), an integral equation that accounts for the interactions between the ice sheets, the solid Earth, and the oceans. Modern approaches to the SLE are based on various techniques that range from purely analytical formulations to fully numerical methods. Despite various teams independently investigating GIA, we do not have a suitably large set of agreed numerical results through which the methods may be validated. Following the example of the mantle convection community and our recent successful Benchmark for Post Glacial Rebound codes (Spada et al., 2011, doi: 10.1111/j.1365-246X.2011.04952.x), here we present the results of a benchmark study of independently developed codes designed to solve the SLE. This study has taken place within a collaboration facilitated through the European Cooperation in Science and Technology (COST) Action ES0701. The tests involve predictions of past and current sea level variations, and 3D deformations of the Earth surface. In spite of the signi?cant differences in the numerical methods employed, the test computations performed so far show a satisfactory agreement between the results provided by the participants. The differences found, which can be often attributed to the different numerical algorithms employed within the community, help to constrain the intrinsic errors in model predictions. These are of fundamental importance for a correct interpretation of the geodetic variations observed today, and particularly for the evaluation of climate-driven sea level variations.